Abstract Submitted to the
International Conference on Strongly Correlated Electron Systems
University of Michigan, Ann Arbor
August 6-10, 2001

Pairing of charge and topological excitations in high-temperature superconductors

Eduardo C. Marino, Marcello B. Silva Neto
Instituto de Fisica, Universidade Federal do Rio de Janeiro
Caixa Postal 68528, 21945-970, Rio de Janeiro - RJ, Brazil

The pairing of charge (electrons or holes) which leads to the superconducting phase transition in high-Tc compounds is investigated in the framework of a continuous theory at zero temperature, which takes into account the magnetic interaction as well as the effects of doping and disorder. Charge doping creates topological defects which, in the antiferromagnetically disordered phase that precedes the superconducting transition, are fully quatized and cannot be described by classical or semiclassical methods. The effective interaction energy of the dressed electrons/holes is evaluated, as a function of the doping parameter, by taking into account purely quantum-mechanical corrections. For a critical value of the doping parameter this interaction energy changes from a repulsive to an attractive behavior thereby leading to Cooper pair formation and superconductivity. It is shown that at this quantum critical point, the original theory is supersymmetric and supersymmetry precludes the occurrence of higher order corrections to this result. We obtain for the critical doping which corresponds to the onset of superconductivity at T=0, the values of x = 0.06 for LSCO and x = 0.42 for YBCO, which are in excellent agreement with experiment.